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# BALING HAY



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**T**HIS BULLETIN aims to help the hay grower solve some of the problems that arise in connection with baling hay; to decide whether to buy a press or depend on custom balers, to select the type of press best suited to his needs if he buys, and to settle to best advantage questions in farm practice that determine efficiency in the setting and operation of a hay press.

Office of the Secretary  
Contribution from the Office of Farm Management  
E. H. THOMSON, Acting Chief  
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# BALING HAY.

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THE WAY in which hay is baled makes a great difference in the price it commands on the market. Careless baling results in bales that are uneven in length, or that have sloping ends, rough edges, and wires improperly placed or tied. Hay baled in this way presents a ragged and unattractive appearance, and will not bring as good a price as it would if put up in bales of uniform size and neat appearance. Furthermore, well-baled hay, with respect to neatness and uniformity, is sometimes classed as improperly baled if the bale happens to be of a size or weight not in demand on the market on which it is offered for sale.

The kind of bale produced in baling hay depends both upon the type of press used and upon the way in which it is operated. Some presses make a "poor feeding bale." Others, when properly handled, make a bale that separates readily into feeds. Even with the best presses, the manner in which the hay is fed into the press determines, in large measure, the ease with which the bale may be divided into feeds of uniform size. There are various practices, some followed unconsciously or merely to avoid extra work, some followed deliberately with intent to deceive the buyer, which tend to lower the market value of hay in the bale, however high its actual quality.

This bulletin describes the several types of hay presses, discusses their adaptability and operation under different conditions, and gives detailed information concerning the management of baling crews. The question of owning a press or hiring baling done is rather fully considered, as it is believed that many hay growers who now hire

custom balers would do well to give careful consideration to the advantages that may accrue from having a press on the farm.<sup>1</sup>

### TYPES OF PRESSES.

Presses are divided into three classes according to the manner in which the bale is made—loose or box presses, perpetual or continuous presses, and round-bale presses. There are two classes according to the kind of power used—those operated by horses, and “power” presses operated by steam, gasoline, or kerosene engines.

#### BOX PRESSES.

The first box presses were operated by hand, but now they are operated by horsepower or by engines. Formerly many box presses made a bale from a single charge, with one stroke of the plunger; and present models use much more hay at a charge than do other types. The box press always makes bales having the same or “even” length, a very valuable feature when loading cars. Bales of even length can be made with a perpetual press also, but not as easily as with the box press.

Some feeders believe that the advantage of even length of box-pressed hay is more than offset by the difficulty experienced in separating the bale into small portions for feeding, owing to the fact that the hay is generally more or less tangled or matted together. Indeed some feeders have such a decided dislike to box-pressed hay, baled from certain makes of presses, that they will not pay as much for it as for hay baled in a perpetual press.

#### PERPETUAL PRESSES.

Perpetual presses are so called because the pressing is continuous; that is, hay is continually fed into the press, a forkful at a time, and the finished bale is discharged from the opposite end of the bale chamber without stopping the press. If the hay is properly fed into the press it will be a very easy matter to separate the bale into as many portions for feeding as there are charges in the bale. The number of charges in a small bale varies from 6 or 8 to 15 or 20. The perpetual press is the leading type in all sections where hay is grown for the market.

#### ROUND-BALE PRESSES.

One of the latest types of presses makes a cylindrical bale, bound with binding twine, and having an air space running lengthwise

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<sup>1</sup>No definite figures on the amount of hay baled in this country each year are available. It is known that about 3,500,000 bundles of bale ties are produced in the United States each year. This amount of ties would provide wire for a little over 17,000,000 tons.

through its center. This press was designed so that hay baled from the windrow would cure out after it was baled, the hold through the center being intended to allow air to circulate through the bale and prevent heating. This bale is not as easily torn apart as the continuously pressed bale, it being necessary to chop or split it lengthwise with an ax or other edged implement. When "round" bales are fed in open bunks or on the ground in the feed lot, they are not opened; the animal pulls out the hay a mouthful at a time. It is claimed that this way of feeding the hay prevents waste. For feeding individual animals in stalls, however, it is necessary to open the bale in some way, which is not easily nor quickly done.

#### HORSE PRESSES.

##### ONE-HORSE PRESSES.

One-horse perpetual presses made by reliable concerns are capable of making the same kind of bales as are made by the regulation 2-horse presses. They are intended for the farmer who has a very small acreage of hay, and they can be especially recommended for the small hay grower if he is in a section where little hay is grown and where hay presses are scarce or hard to hire. The only objection to this type of press is its small capacity per day. If the prospective purchaser is in doubt as to which size to buy, it would probably be better in many instances for him to buy the 2-horse press. If hay is to be baled from the windrow or cock, the 2-horse press should be purchased in preference to the 1-horse press, since there is less danger of unfavorable weather injuring the hay when using the larger and more rapid size. The 1-horse press can be used to advantage if hay is baled from the stack or barn at a time when there is no urgent need to do other farm work.

##### TWO-HORSE PRESSES.

The 2-horse, full circle, or continuous-travel perpetual press is the type of horsepower press most extensively used. In operating this type of press the horses travel in a circle.

The following important points should be considered when buying a press of this type: The power mechanism, material (wood or steel) used for important parts of the press, size of feed opening, plunger return device, self-feeding attachment, and convenience in tying the bales, setting, and moving the press.

The power mechanism should be heavy, durable, and simple in construction, should work smoothly without too much loss of power on account of friction, and should be cumulative; that is, the leverage

of the horses should increase in proportion as the hay becomes compressed, so that when the heaviest pressure is needed the power delivered is greatest. The mechanism should be so arranged that the heaviest pull does not occur when the team is crossing the step-over bridge, but when parallel with the press. (See Fig. 1.) With some

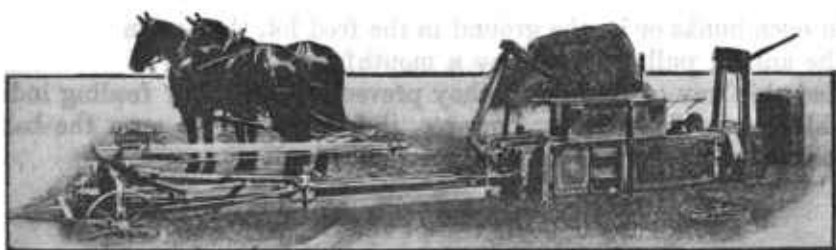


Fig. 1.—A good type of two-stroke, two-horse press equipped with mechanical feeder arm. It makes the same kind of bales as does the ordinary power press.

makes of presses the plunger remains stationary after it has withdrawn from the bale chamber, while the team travels several feet. This is an advantage, as it gives the feeder sufficient time to put a full charge of hay into the feed chamber.

The plunger is usually returned either by a device directly operated by power or by a spring. In either case the action should be positive.

The size of the feed opening determines the quantity of hay that may be fed at one charge. It also determines the ease with which the press may be fed. Presses with small feed openings are hard to feed and may easily be overfed. Overfeeding results in bales with ragged edges.

Feed chambers are of two types, stationary and condensing. The stationary type is found on many of the older models of presses. The condensing type expands to receive the hay, and before the plunger starts to press the charge it contracts and partially condenses the hay. This feature increases the capacity of the press.

Some presses are equipped with a self-feeder attachment, which does away with the somewhat dangerous necessity of using the foot to trample the hay down. Some makes of presses are equipped with both the condensing feed chamber and the self-feeder device.

A good press should operate in such a manner that the overlap is handled properly. This is accomplished by means of a roller or folder, which should work freely and turn down the overlap smoothly, making even bales when different-sized charges are fed.

The tension should be simple in construction and easily adjustable and the division block should fall into the bale chamber readily and with the least possible loss of time.

The number of strokes made by the plunger while the team travels once around the circle is a very important feature, for upon the strokes depends the capacity of the press. Many presses are known as two-stroke presses, which means that the plunger makes two strokes while the team travels once around the circle. Recently three-stroke presses (see fig. 2) have been placed on the market. It is claimed that these presses have a much greater capacity than the two-stroke presses, and this probably is true. This type of press may be harder on the horses than the two-stroke press, since the team is required to do half again as much work per hour. Some owners of this type of press change the team often, which enables them to bale more hay per day than they otherwise could.

The length of the stroke, construction of the head block and chaff grate, height of the step-over, adaptability to barn work, time and labor required to set and get the press ready for moving, etc., are points to be considered.

#### REVERSIBLE-LEVER OR HALF-CIRCLE PRESSES.

The reversible-lever type of press is sometimes called the half-circle press, since the team travels half a circle, turns around, and pulls the lever to the other side, a charge of hay being pressed for each half circle. This type is easily portable and is always ready for work, since it is not necessary to take off the wheels or lower them into the ground to the axle or to stake the front end of the press. Compared with the continuous-travel press, it has a smaller capacity per hour and requires a team well trained to the work to operate it to its capacity. With the continuous-travel press a team not accustomed to the work requires little breaking in; in fact many teams require no driver and others need only the occasional applica-

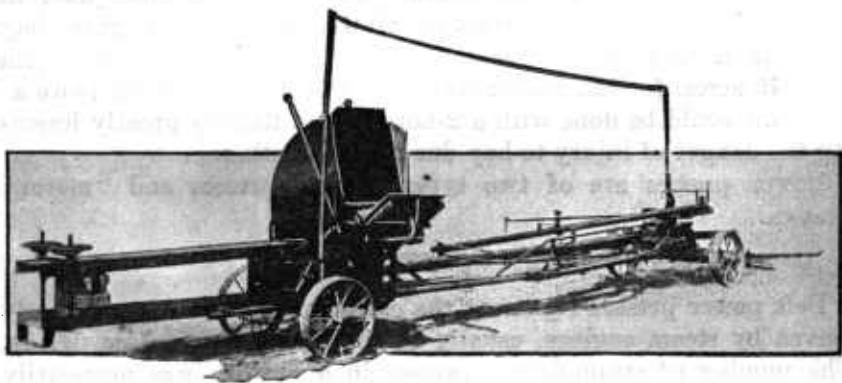


FIG. 2.—Type of all-steel, three-stroke, two-horse press used extensively in the Middle West and South. The three-stroke type is capable of baling more hay per day than the two-stroke type, especially if a heavy team is used and the crew puts forth its best efforts.



tion of the "patent whip," a mechanical device operated by the press feeder in "touching up" the horses. A "green" team used on the half-circle press requires the services of a driver, and even then is slow in turning, which lowers the capacity of the press, thereby increasing the cost of man labor per ton of hay pressed.

#### SERVICE RENDERED BY HORSE PRESSES.

In Craig County, Okla., it was found that the average life of the ordinary continuous-travel, or "full-circle," 2-horse perpetual press was a little over 13 years, in which time it baled a total of more than 5,000 tons of prairie hay. The average use was 40 days each year. The repairs amounted to about 2 cents per ton. The total cost of repairs, interest, and depreciation or replacement charges amounted to a little less than 9 cents per ton of hay baled.

In the "black belt" of the South horse presses have been found to give service for about 14 years, in which time the average press baled a total of more than 4,500 tons of Johnson grass and alfalfa hay. They were used 44 days per year. The repairs amounted to about 2 cents per ton, in 1917, and the total cost of repairs, interest, and depreciation or replacement charges amounted to about 10 cents per ton of hay baled. Thus, in the long run, it is not expensive to own a 2-horse press, even though the original cash outlay may seem large.

#### POWER PRESSES.

Large hay growers and those shippers who buy and bale large quantities of hay generally use power presses. These are in common use in sections where the usual practice is to bale hay from the windrow or the cock, such as the alfalfa and Johnson grass and prairie hay sections of the South. They are sometimes used in preference to the 2-horse type on alfalfa and Johnson grass hay farms even where the hay acreage is comparatively small, say from 50 to 75 acres, for the reason that they will bale hay about twice as fast as it could be done with a 2-horse press, thereby greatly lessening the danger of injury to hay due to bad weather.

Power presses are of two types, "belt" presses and "motor" presses.

#### BELT PRESSES.

Belt power presses represent the earlier type, and were formerly driven by steam engines, usually of the traction type (see fig. 3). The number of steam-driven presses in a locality was necessarily small because it seldom paid to purchase a traction engine to be used only for driving a press. Until recently, therefore, power presses

were owned, for the most part, by those who had thrashing outfits, and who made a business of doing custom baling as well as thrashing.

As power to drive hay presses, the steam engine, portable or self-propelling, has been almost entirely superseded by the gasoline or kerosene engine. With a gas engine there is no need for an engineer and a water hauler. A few owners employ an engineer when doing custom baling with a fast-working crew, because he keeps the engine going and saves expensive loss of time on the part of the press crew. When the crew is hired by the ton the men are not paid for



FIG. 3.—The first power presses for baling hay were operated by persons owning steam thrashing outfits, and consequently there were comparatively few power presses in each community. The internal-combustion type of engine has now largely superseded the steam engine for use in baling hay, doing away with the necessity of an engineer and of a water hauler and his team.

time lost on account of a break-down, and in such cases engineers are not often employed. Usually one of the press crew looks after the engine when it requires attention.

Under certain conditions the belt power press is the best type for the hay grower who does his own baling. On farms where tractors are used, if the tractor is not needed for other essential work when it is time to bale hay, then the belt power press should ordinarily be used, since it costs less than the motor press, and since it would not be good business to use a motor press while a tractor stands idle. Under other conditions, however, to be mentioned later, it is good business to buy a motor press, even when the hay grower owns a tractor that is idle during the time in which hay is being baled.

Some belt presses are made so that an engine may be easily attached later, if desired.

**MOTOR PRESSES.**

Presses that have the engine mounted on the hay press frame are known as motor presses. The engine is either directly connected to the press by gears, or drives it by means of a belt or chain.

**IMPORTANT FEATURES OF POWER PRESSES.**

With regard to the material used in the construction of power presses, there is a choice between the press having a wooden frame and steel bale chamber and the solid steel press. The steel press costs more than one having a wooden frame. There is considerable

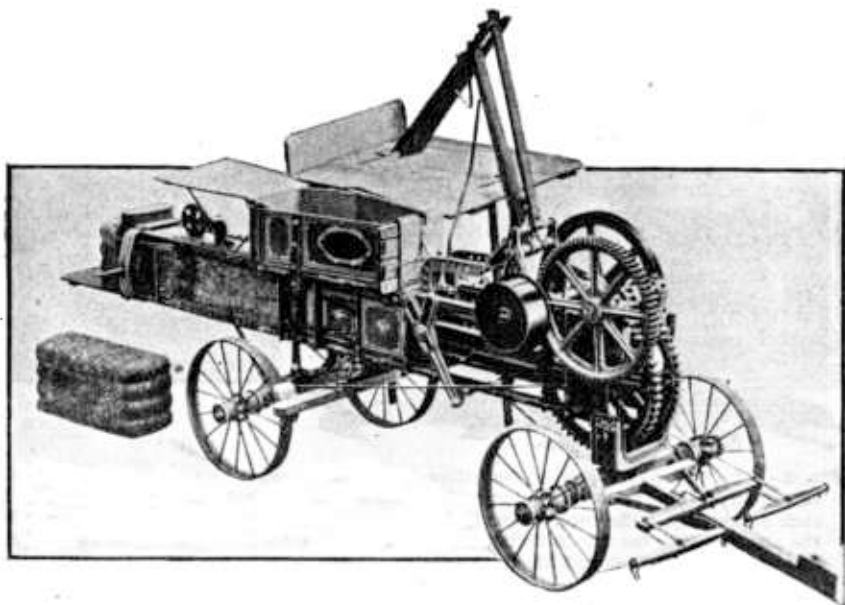


FIG. 4.—A well made, improved belt-drive type of press, suitable for baling a large tonnage yearly. Note heavy drive gears, condensing feed chamber, and mechanical feeder arm.

difference also in weight between light-duty and heavy-duty presses. The heavier built presses cost considerably more than the lighter presses.

If the press is needed for use on only one farm or for a comparatively small acreage of hay, the light-duty press will prove satisfactory, but for use on large hay farms or in custom baling, the higher-priced, heavy-duty press will save money in the long run (see fig. 4). Cheap presses will not stand up very long under hard work, as when used by a fast-working crew, or when the hay is "tough," or of a kind that is hard to bale.

The life of a press depends, to a considerable extent, on the type and size of the gear that drives the plunger. On some presses a

single gear is used, while on others it is double, sometimes of the elliptical type. With the elliptic gear the plunger moves rapidly at the beginning of its stroke, when the hay in the bale chamber is loose, but moves more slowly, with ever-increasing leverage, as the hay becomes more condensed, until near the end of the stroke it delivers a tremendous pressure. The plunger is returned quickly, in order to allow all of the time possible to feed the hay into the press.

On some presses flywheels assist in the compression by furnishing reserve power when the engine is doing its hardest work. Other presses are made without flywheels, because when any unyielding object, such as a block or fork, is caught in the press something may be broken before the momentum of the flywheel can be overcome and the press stopped. This danger is avoided on some presses by having a clutch, operated by a lever on either side of the press, which instantly stops the press, but not the flywheel.

An automatic condensing feed opening is an advantageous feature. A large, roomy feed platform aids the feeder in selecting the proper amount of hay to feed into the press at one time. Some presses have an apron feed, which allows the feeder to stand on the ground and do work that otherwise would take two men. It is important to have a good and safe automatic block dropper.

The size of the gasoline or kerosene engine needed for driving a power press varies from about 5 to 15 horsepower, depending upon the type and size of press and the degree of compression to which the hay is to be baled.

Other desirable features, such as a good-sized feed opening, long tying chamber, swivel carriers for feeding the hay to the press, bale signal bell device, and ease of tying the bales, should be borne in mind when deciding what kind of press to buy.

The capacity of a press depends to a large extent upon the skill of the crew operating it. The average power press should bale from 20 to 30 tons per 10-hour day. The capacity of a power press, under average conditions, is about twice that of a 2-horse press.

#### SERVICE RENDERED BY POWER PRESSES.

In northeastern Oklahoma it was found that the average life of a power press was  $14\frac{1}{2}$  years. Power presses were used an average of 47 days per year and baled 1,000 tons per year, or a total of 14,500 tons. The repairs amounted to about 2 cents per ton baled, and the total machinery charges, including repairs, interest, and replacement charges, amounted to about  $7\frac{1}{2}$  cents per ton.

In the alfalfa belt of the South it was found that the average life of a power press there was  $12\frac{1}{2}$  years, in which it baled a total of 7,500

tons of hay. It was used about 41 days per year. The repairs amounted to  $3\frac{1}{2}$  cents per ton baled, and the total machinery charges, including repairs, interest, and replacement charges, amounted to about 15 cents per ton. That the cost of repairs, etc., for power presses was higher in the alfalfa district was partly due to the fact that many press owners had had little experience with hay presses at the time of the investigation, partly to carelessness on the part of laborers, and partly to the condition of the hay; "tough" hay is hard on the press.

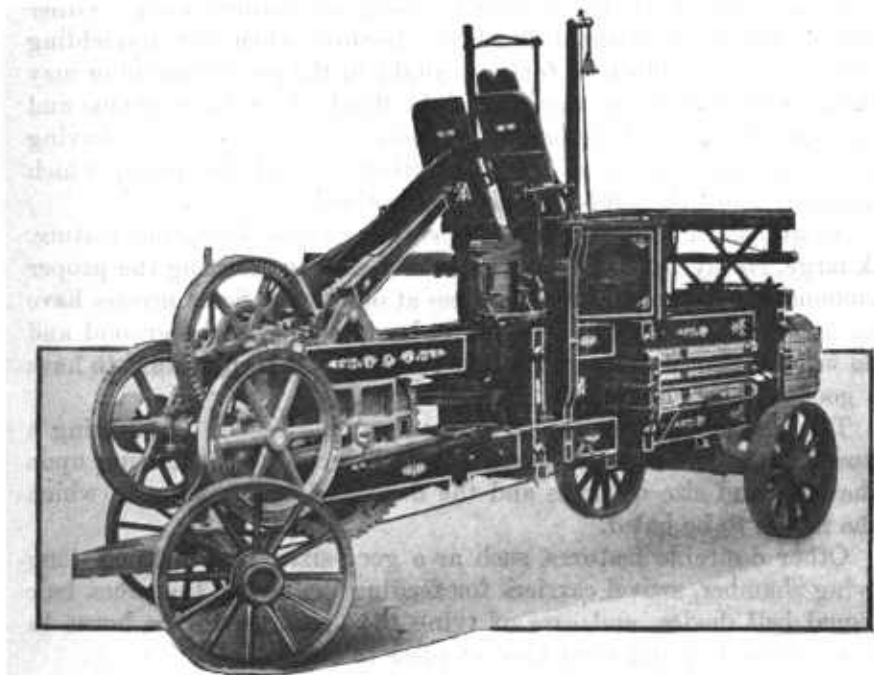


FIG. 5.—A heavy-duty compress, used for baling hay with a high degree of compression. These machines are used, at present, mostly for the export trade, but may come into use for baling hay to be shipped long distances in domestic trade, as, for instance, western hay shipped through the Panama Canal to the Southern States.

The machinery charges on power presses are not excessive when they are operated by those who use a little care and judgment and are familiar with the manner of operating this type of press.

A good belt power press can be purchased for from about \$400 to \$600. The motor presses equipped with engine cost from about \$600 to \$800, depending upon the make and type.

### COMPRESSES.

Compresses are used almost exclusively for baling hay for export. They press a ton of hay into a space of from 50 to 70 cubic feet.

Their use is rather limited and they will not be discussed in this bulletin. Those intending to double-compress hay should take the matter up with manufacturers who make large presses for special purposes. (See fig. 5.)

### SIZE OF BALES.

The size of bale that a press makes sometimes has a great effect on the selling price of the hay. On some markets the difference in selling price between hay in large bales and that in small bales is considerable.<sup>1</sup> The successful grower of market hay keeps informed as to just what the market to which he ships his hay demands in regard to type, size, and weight of bales.

Some feeders object to tightly baled hay because they believe that the "life" is pressed out of such bales. Some prefer the large, loosely-pressed bales, believing that the hay in them has a greater feeding value than that in small, heavily-pressed bales. Sometimes small bales are desired on account of the ease with which one man can handle them, or because it is easy to detect the presence of spoiled hay in a small bale. To realize the greatest possible profit from the sale of his hay, the hay grower must put his hay into a package that will suit the feeder's ideas rather than his own.

The sizes in general use now are as follows:

#### Small bales:

14 by 18 inches, variable in length, usually 36 inches.

16 by 18 inches, variable in length, usually 36 inches.

#### Medium bales:

17 by 22 inches, variable in length, usually 36 inches.

18 by 22 inches, variable in length, usually 36 inches.

#### Large bales:

22 by 26 inches, variable in length.

22 by 28 inches, variable in length.

19 by 23 by 46 inches.

26 by 30 inches, variable in length.

### WEIGHTS OF STANDARD BALES.

The weight of perpetual-press bales of standard sizes varies considerably. Small bales made by the 14 by 18 and the 16 by 18 inch presses run from 60 to 100 pounds, medium bales from 100 to 150 pounds, and large bales from 150 to 250 pounds. By proper adjustment of the tension device the weight of perpetual-press bales may be easily controlled so that uniform bales of almost any desired weight, within the limits just mentioned, can be made. When the tension is tightened the delivery opening is made smaller, necessi-

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<sup>1</sup> See quotations for the New York and Boston markets for hay in different kinds of bales.

tating more power to force out the partly finished bale, and resulting in a higher degree of compression just before the wires are tied. Loosening the tension lessens the compression, and the result is a lighter bale.

Box-press bales may vary considerably in weight, depending upon the skill of the feeder in estimating the amount of hay to feed into the press for each charge, as box presses have no tension device to regulate the compression.

#### LIGHT BALES ARE EXPENSIVE TO SHIP.

In shipping baled hay it frequently happens that it is not possible to load to even the minimum weight with light-weight bales, if the car is of the older and smaller type. In some instances it is impossible to load the minimum weight into a car with bales weighing 60 to 70 pounds, whereas if the same-sized bale contained from 90 to 100 pounds this difficulty would not be experienced. It is important to make bales that will at least load cars to their minimum weight, provided a serious discrimination in price does not result from their being overweight. In a few instances the trade will now take a heavier bale than formerly and pay the same price per ton as for the lighter bale. *The feeding value of hay is not impaired in the least when it is tightly baled.*

#### CONDITION OF HAY FOR BALING.

The condition of hay when baled influences to a marked degree the rate of baling, which, in turn, controls the amount of man labor required per ton and, in some instances, has a bearing upon the keeping qualities of the baled hay.

#### BALING PARTLY CURED HAY FROM BARN OR STACK.

Apparently well-cured hay often goes through a "sweat" or "heat" soon after it is put in the stack or barn. While going through this stage hay becomes moist and "tough," and more or less heat is developed, though not enough to injure hay that has been cured properly. This sweating and heating is generally believed to be advantageous, since it develops aroma and palatability. The heating of hay in the barn or stack is usually over in from three to six weeks. Then the hay is dry again and the curing process is complete.

Hay that is going through the sweat and is moist or "tough" does not work well in the press, and considerably more power is required than to bale hay that has gone through the sweat. When baling hay in this condition, or hay that has been wet by rain, it often becomes necessary to loosen the tension and make excessively light bales. If

the hay is baled in a very wet condition it may spoil in the bale. After the sweating process has gotten well under way hay should not be baled until it has passed through the sweat, but this does not apply to the baling of hay in which the sweating has not started, as, for instance, from the windrow.

#### **BALING NEWLY-STACKED HAY.**

It is sometimes a good practice to bale hay from the stack before it begins to sweat. In the prairie hay regions hay is sometimes baled when it has been in the stack but a day or two. This is done to provide work for the crew at a time of day when no other work is available. Large crews hired solely for making hay often receive pay for a full day's work, even when they are unable to work at haying for several hours in the morning on account of heavy dew or rain. Such loss of time can be obviated by opening a stack of new hay that has not started to "sweat" and keeping the crew busy baling at times when the hay in the swath or windrow is not in condition to be handled. In sections where hay is stacked, this practice utilizes labor to the fullest extent. Inexperienced pressers, however, should guard against trying this method when the hay in the stack is not in condition to be baled. It can not be used early in the prairie hay season, unless the hay is exceptionally well cured. If it is not fairly dry when stacked it very quickly becomes tough and hard to bale. As the haying season advances and conditions improve for curing, the hay is usually well cured when stacked and can be baled easily before heating takes place.

#### **HAY BALED DIRECTLY FROM THE FIELD MUST BE WELL CURED.**

Hay is often baled directly from the windrow or cock before it has cured out sufficiently, or after it has been well cured but later has been wet by rain. In either case it is not in proper condition to be baled. No set rule nor simple test can be given to determine beyond any doubt as to when hay can be baled with safety. The appearance of hay is often deceptive. Hay that seems to be well cured in the windrow may heat and spoil in the bale. The ability to judge correctly when hay is in proper condition for baling comes only with experience, and depends upon careful observation of the factors that have a bearing on curing, such as heaviness of stand, the handling the hay has received, such as tedding and turning in the windrow, condition of the weather with respect to per cent of humidity in the air, temperature and amount of wind stirring, and length of time the hay has been cut.

There is one test, however, that will indicate directly, to a certain extent, the fitness of hay for baling. This is to try a handful of hay



by twisting it with the hands. If it breaks easily when twisted once or twice, then it is well cured, but if it is hard to break, and sap is squeezed out of the stems, it is not in condition to be baled. If there is any doubt about the hay being in condition for baling, it is best to "play safe" and wait a little longer, say half a day or a day, so as to be absolutely certain that it will keep when baled.

#### **BALING FROM THE FIELD HAY THAT IS WELL CURED BUT DAMP ON TOP.**

Men who bale all or the larger part of their hay from the field sometimes knowingly bale hay that is not in an altogether desirable condition in order to prevent loss of time on the part of the crew. The hay baled in such cases is usually hay that has been well cured in the cock, and has been dampened on top somewhat by a light shower. In many instances under such circumstances the hay is in a "betwixt and between" condition and the crew is undecided whether to bale or not. If there are indications that the sun will soon come out to dry the hay, the press is usually started, since the hay is not so damp as to hurt it materially and it is good management to keep the crew busy, even if the hay does work hard in the press. If, however, the weather continues to remain only threatening, hay may be baled all day or until sufficient rain falls to stop the press.

It may be well to add a word of caution about baling slightly damp hay. If the hay has not been thoroughly cured before it is affected by rain or damp weather, or if the hay grower is not absolutely certain that the hay will keep, it is best to wait until conditions are known to be favorable beyond a doubt; otherwise the baled hay may heat and spoil sufficiently to affect seriously its feeding value.

#### **BALING "DRY" HAY.**

"Dry" is a term used by city feeders to designate hay that is too dry when baled. Dry hay will keep better than that having a normal moisture content, which is about 12 per cent for well-cured timothy, and 14 per cent for clover, but such hay is sometimes discriminated against because grass hays are believed to lack palatability when dry, and clover, alfalfa, and grain hays "shatter" when handled. Hay grown in irrigated regions is more likely to become too dry than that in the eastern part of the United States. The loss of leaves, the most nutritious part of the hay, in the case of dry alfalfa may amount to several pounds per bale from the time it is baled until it reaches the consumer.

For these reasons absolutely dry hay is not in the best condition for baling. Such hay is also sometimes more or less dusty and unpleasant to handle, and it can not be put through the press as fast

as hay that contains a very little more moisture. It breaks and is crushed more or less under heavy pressure and can not be made into such smooth-looking bales as hay that is in just the right condition for baling. Then, too, the self-feeder sometimes cuts through the feed of dry hay, and fails to push it well down into the bale chamber. This necessitates more feeds per bale, and consequently more time is required to bale a ton.

## OPERATING THE PRESS.

### WHERE TO SET THE PRESS.

#### AT THE BARN.

When hay is baled from the general-purpose barn the driveway is the only place where the press can be set. The 2-horse press does not lend itself as readily to barn work as do power presses, especially those of the motor type. When a horse press is used at a bank barn it is sometimes necessary to place the press just outside the door, in order to allow the team space enough for its circle. This setting necessitates moving the hay some distance to get it from the mow to the bale chamber, and the arrangement is otherwise rather awkward in that the loose hay must be carried around past the discharge end, which interferes, more or less, with the man tying the bales. A better arrangement is possible in barns having the floor on a level with the ground, since there the rear end of the press may be set some distance inside the barn. This arrangement saves considerable labor, since it enables the pitchers to deliver the hay directly to the man feeding the press. Power presses can usually be set well inside the ordinary barn.

Motor presses are admirably suited for baling hay from large barns built especially for the storing of hay. In baling in a barn of this type, the press is set in the driveway and the hay is baled from one half of the barn first. It is good practice, when baling in long barns, to move the press occasionally toward the hay, rather than move a large quantity of hay from the extreme end of the barn to the press. Considerable labor can be saved by this practice, since it takes but a few minutes to move the press nearer to the unbaled hay.

#### IN THE FIELD.

When hay is baled from the windrow or cock the amount of man and horse labor required to bring a ton of hay to the press depends directly upon where the press is located with reference to the area to be baled.

The most economical method as regards man labor needed in getting hay to the press is to haul it with the push rake (also known under the names of sweep rake, bull rake, go-devil, etc.). The press should be in the center of the area to be baled during the set. If one push rake is able to handle enough hay to keep a press going to capacity, when set in the center of a square piece of land, it will require two push rakes to keep it going if it is set at one corner of that piece.

#### AT THE STACK.

When baling from the stack the press should be set, if possible, so that the hay can be pitched with the wind. This can not always be done in the cases of stacks built in a corner, or against a fence. The place where the press should be set sometimes depends on the type and size of the stack. In setting for baling from a round stack, it is necessary only to see to it that the press is not set too close, so as to prevent the feeding table from being put in place. When a long rick of the ordinary size is to be baled, the press should be set at the side of the rick, midway of its length. If set at or near one end it may be necessary to use at least one and possibly two more men than would be required if the press were set midway.

Very long ricks should not be baled out at one set, but should be cut into two or more sections with a hay-knife, the press being moved along the side of the rick as the sections are baled. By following this method, with the smallest possible number of men on the stack, as much hay can be baled per hour as when using enough men to handle the whole rick at one set.

#### DUTIES OF THE PRESS CREW.

The labor involved in baling hay includes pitching hay to the press, feeding the press, tying the bales, bearing away bales, and (with the horse press) driving the team. Occasionally, as has been already explained, an engineer is required for a power press.

The duties of each member of the crew should be clearly understood by all, in order to avoid friction.

Many presses are operated entirely by hired labor, and often the owner of the press is on the job only occasionally. This makes it necessary to have a man to act as foreman or overseer. He may or may not assist in the work. In the North and West, he usually works as one of the crew. Southern presses are operated mostly by unskilled negro labor, and a white overseer is generally needed. This man should thoroughly understand the operating of the press, for upon him depends quite largely the output per day.

## FEEDING THE PRESS.

The most important work, in some respects, is feeding. The make-up of the bale, the uniformity of its contents, and the amount of hay baled in a given length of time are dependent upon the efforts and ability of the feeder, provided a full crew is used and each one is doing his full duty.

The mode of feeding depends somewhat upon the type of press. If the press is not equipped with a feeding table the feeder must pitch the hay from the ground to the bale chamber. The most important thing in feeding a press is to feed regular and uniform forkfuls. The size of the charge should be such that it can be fairly easily and quickly put into the bale chamber before the plunger acts on it, without leaving a portion protruding to form an overlap which strings along from one charge to another and tends to mat the charges together. If the press has a stationary bale chamber, and is not equipped with a mechanical feeder, the hay is usually pushed down into the bale chamber with a pitchfork; often the feeder uses his foot, especially with the horse press. This practice is dangerous, and may result in the loss of a foot, or in a badly crushed ankle. In rare instances a feeder will use his bare hands to wad up the hay and force it into the bale chamber. Few feeders, however, care to use their hands for this kind of work.

Presses having mechanical feeders are more easily fed, it being necessary merely to pitch the hay into the press, where it is forced down into the bale chamber by the feeder arm. An automatically expanding and contracting feed chamber is also a great assistance to the feeder.

Most presses are equipped with a feed table. A large table enables the feeder to do better work than a small table, as it keeps before him more hay from which to select the proper amount to feed at a time. In order to bale as much hay per hour as is possible the hay should be delivered to the feeder by the pitchers in just the right amounts and at the right time. If each pitcher pitches just enough hay at a time for the proper size of feed or charge, then it is an easy matter for the feeder always to deliver the hay to the press when it is required without missing any feeds, or at most but few. If the hay is piled up in profusion on the feed table it will greatly hinder the feeder and reduce the output. Such crowding makes the feeder do extra work, for he must take more time to separate out a proper-sized feed, and as a result he may miss some strokes of the plunger, or his feeds may become irregular, some very light and others heavy, which tends to choke the press.

The feeder usually drops the block which separates and determines the length of the bales. He does this when notified by the tier or when warned by an automatic bell signal.

One of the most important duties of the feeder has not been mentioned—the making of bales containing as nearly as possible but one grade of hay, and avoiding the production of what is called “sandwiched” hay; that is, bales containing poor hay sandwiched in between charges of good hay. This is one of the most objectionable practices in baling hay.

When the yield is larger than the average in sections where it is the practice to store hay in barns, the surplus is often stacked for three or four weeks, or until it has gone through the sweat, and then baled. If the weather remains favorable there will probably be no badly spoiled hay, though the top and sides of the stack may become bleached. Many farmers bale this bleached hay with the unbleached. When the badly bleached hay or the rotten hay around damaged spots in the stack is not carefully discarded in baling these spots lower the grade of the whole.

Sometimes spoiled hay is intentionally placed in the middle of the bale. As a result of this deliberate sandwiching by a few unscrupulous balers or shippers, any bale showing even a very small stain or spoiled spot on the outside is, in most markets, regarded with suspicion by both inspector and buyer and is graded down, even though it frequently develops that the quantity of inferior hay is not more than a handful.

It is the duty of the man feeding the press to throw out all stained, spoiled, or rotten hay, since its presence in the bale causes a direct loss of money to the hay grower.

#### WIRING AND TYING.

Wiring and tying, usually termed “tying,” is fully as important an operation as is feeding. The manner in which the wires are put on and tied determines quite largely how much handling the bale will stand, which in turn affects its market value. On many types of presses not equipped with bale-signal devices the making of bales of even length depends upon the alertness of the tier. Also the capacity of the crew is dependent more or less upon the ability of the tier to tie the bales as fast as the hay is fed into the press.

The position in which the tier works depends upon the type of press. Presses operated without removing the wheels are arranged so that the tier can stand or in some cases sit, usually on a bale of hay, while working. With some horse presses it is necessary for the tier to work on his knees or to sit on the ground. This position is probably the most uncomfortable of all.

One man usually does the tying when the horse press is used. Power presses require the services of one tier and an assistant, who may or may not do other work, depending upon how fast the hay

is being baled. When the press is being operated very fast it will require the entire time of two men or one man and a boy to place the wires and tie them.

There are two methods of tying. One method is to tie both wires, or all of them in case more than two are used from one side. When this is done the tier runs the sharp ends of the wires through the slots of the division block as soon as it appears and the man or boy on the opposite side runs the same ends back through the slots of the next division board as soon as it appears. Another method is to tie half of the wires on each side. This takes two men. The tier usually has plenty of time to make his tie if the division block has been dropped at the proper time. If it has been delayed one or two charges, it will then be necessary for the tier to make a splice in order to make the wires long enough. Sometimes when the wires are tied without splicing on bales that are too long they will break if they are too small to stand the expansive force due to the presence of the extra hay put into the bale. In order to save time a supply of splice wires looped at one end should be kept on hand.

Sometimes when two men are used for wiring and one does the tying the other has time to act as off-bearer, to take away and pile the baled hay and return the division blocks to their proper place for being put into the press.

In order to wire bales properly the tier must watch constantly to make certain that the wires are of the same tension after being tied, especially if but two wires are used. If one wire is tied tighter than the other, the side it is on will be shorter than the other and the bale will be "humped" or crescent-shaped, and will come apart easily when handled. On some markets there is no demand or sale for broken bales, such hay being classed as "loose" hay. The hay grower often has to stand the loss occasioned by improper wiring, especially when he ships his own hay. If three wires are used instead of two, as is customary on the 14 by 18 inch and the 16 by 18 inch sizes, the bales will stand handling and shipping much better than those having only two wires.

#### PITCHING TO THE PRESS.

The pitchers perform a very necessary part in baling, though their work is less exacting than that of the feeder and tier, in that it requires such qualities as strength and endurance rather than alertness and skill. It is the duty of the pitchers to deliver the hay to the feeder at regular intervals and in such quantities as he may desire. Failure to pitch the hay regularly decreases the amount baled per hour, while pitching forkfuls of irregular sizes causes extra work for the feeder, as has been explained.

Experience on the part of the pitcher is desirable, and an experienced pitcher is an asset to a crew, but when it becomes necessary, as is often the case, to use a "green" man, it is much better to have him pitch than to try to feed the press or tie, because he can learn to pitch even-sized forkfuls to the press easier and quicker than he can learn to feed or tie.

The way in which the pitchers work makes a great difference in the ease with which the hay is handled, and may thus limit the quantity of hay that is delivered to the press or make a difference in the number of pitchers required. This is well illustrated in baling hay brought to the press with push rakes. If the hay is brought close

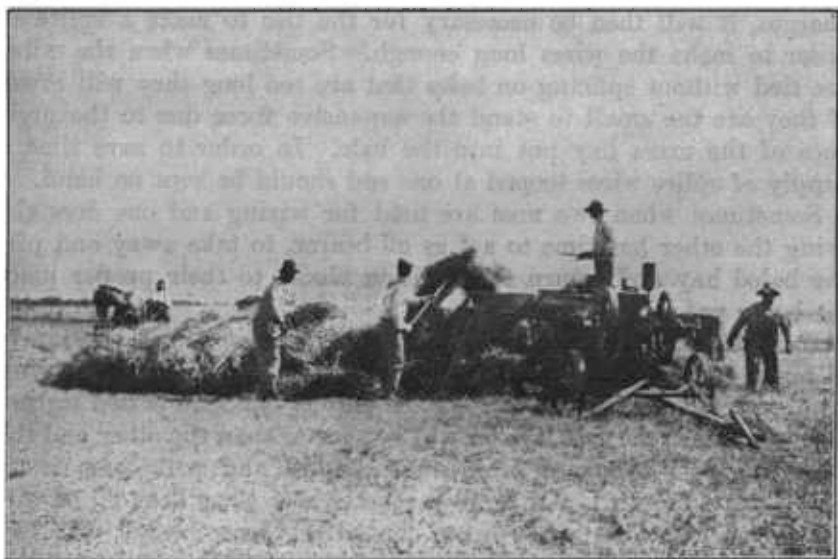


FIG. 6.—Pitchers working at a disadvantage. The push rakes have dropped their loads so far away from the press that one man must pitch all of the hay to a second, who pitches it to the feeder. Working in this manner, two men can not get the hay to the press fast enough to keep it running to capacity.

to the press, only two pitchers will be required, each of whom can pitch the hay directly from the pile to the press. With this method two men can keep the press going, and each will handle one-half of the hay. If, however, several push rake loads are allowed to accumulate at the press, it soon becomes necessary to move the hay a considerable distance to get it to the press. One way is for each man to carry his forkful to the press. The other and most common method is for one man to pitch to the second, who pitches to the feeder. (See fig. 6.) In this case each man pitches all of the hay, and often it becomes necessary to add one or more pitchers in order to keep the same quantity of hay coming to the press as was handled

by the two men when working with hay dropped close to the press. (See figs. 6 and 7.)

When baling from the stack, from two to four men are used for pitching, depending upon the size of the stack and the capacity of the press. The hay nearest the press can be pitched to the feeder without it being necessary for the pitcher to walk more than a few steps. The hay from the far side and ends of the stack is usually pitched to a man near the feed table, who passes it on to the feeder. This arrangement keeps a steadier stream of hay going to the press than when each man brings his forkful from various parts of the stack and pitches it himself to the feeder. It is sometimes customary

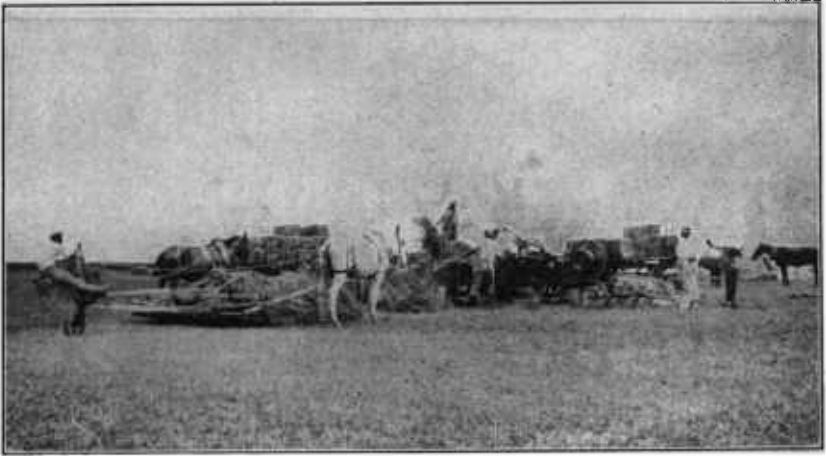


FIG. 7.—A well-arranged baling crew. The push rake loads of hay are dumped but one at a time, close to the press. This method makes it possible for each of the two pitchers to pitch half of the hay in the proper-sized forkfuls for feeding the press.

for the pitcher nearest the press, who handles more hay than any of the others, to change places with one of the other pitchers once in a while in order to rest.

A very important part of the duty of the pitchers when hay is baled from the stack is carefully to avoid pitching stained or spoiled hay to the press. This hay should be thrown off of the stack. While the press is being set the pitchers should open up the stack and get rid of all the surface hay that is damaged. If the hay is baled by a custom crew the owner of the hay should be on the job to see that all spoiled hay is thrown out, for the loss caused by baling unfit hay is his personal loss.

#### DUTIES OF THE OFF-BEARER.

The duties of the off-bearer, in general, are the least important and least exacting of all. His work often is merely taking away



the bales and placing them in a pile or on a wagon, and taking the division blocks, as soon as they come from the press, and putting them in position to be used again. Anybody having enough strength to lift the bales can do this work. If the bales are to be weighed his duties become more important, for often the cost of hiring the baling done, and the amount of hay sold, are reckoned from the weights marked on the tags attached to the bales.

### SIZE AND MANAGEMENT OF BALING CREWS.

Upon the management of the crew depends the number of men that are needed and the cost of baling. The hay grower who hires



FIG. 8.—The cheapest and best method of getting hay from the cock or windrow to the press in the field. A good strong span of mules or horses and one man or boy with a push rake can often handle enough hay to keep a power press running to capacity.

his hay baled is affected indirectly by crew management, for the custom baler's charges depend, more or less, upon the efficiency of his crew.

In some rather rare instances the cost is in a sense a minor matter, the prime consideration being to arrange the work so that baling can be done with the hands available. Take, for example, the problem of determining whether to bale from the cock or the windrow. On certain southern hay farms the custom is to haul from the cock to the press in wagon beds. This method requires the services of six men, six horses, and three wagons to haul hay fast enough to keep a power press going. If five men (the usual number) work at the press, it will be necessary to use a total of eleven men to bale hay by this method, which is more than are available on some farms.

Therefore usually the hay will have to be stacked or some more efficient method used to get it to the press. The push rake will solve the problem in a case like this, since one push rake, or at the most two, will be enough to bring the required amount of hay to the press. (See fig. 8.) By rearranging the work in this manner it can be done with six or seven men instead of eleven. This example has been given as illustrating the importance of studying crew management.<sup>1</sup>

#### SIZE OF HORSE-PRESS CREWS.

The 2-horse press requires but few men to operate it. The number varies from three to five men, and if the team requires a driver one more, usually a boy, is needed. The ordinary 2-stroke press requires one feeder, one wirer, and one or two pitchers. The use of the "patent whip" does away with the necessity of a driver to keep the team on the press going steadily. The amount that can be baled per day varies considerably with the kind and condition of the hay baled, and very largely with the ability and willingness of the crew. A 2-horse press will bale from 6 to 15 tons of hay per day, the average probably being about 8 tons, although many crews will bale 10 tons per day from the windrow.

#### SIZE OF POWER-PRESS CREWS.

Much more variation is found in the size of power-press crews than in horse-press crews. The smallest regular-sized crew consists of four men. The crew is arranged as follows: Two pitchers, one feeder, and one wirer. A crew of this size can not be expected to bale as much hay in a day as the standard crew of two or three pitchers, one feeder, two wirers, and one off-bearer, in all six or seven men. The amount of hay baled by such a crew varies from 20 to 30 or more tons per day.

#### SHORT-HANDED CREWS.

In some parts of the prairie hay section of Oklahoma it is customary to run power presses with a short-handed crew of one pitcher, one feeder, and one wirer. This 3-man crew will bale about the same amount of hay as a 3- or 4-man crew baling with a 2-horse press. Short-handed crews are used chiefly on account of inability to get enough men to make up a standard crew. Then, too, sometimes there is no great hurry in getting prairie hay baled, as there is in baling timothy or alfalfa, since the prairie haymaking season extends over a period of several weeks, or even months.

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<sup>1</sup> For detailed information along this line, see U. S. Dept. of Agriculture Bulletin 578, entitled "A Study of Haymaking Crews and Labor Costs," and Farmers' Bulletin 943, entitled "Haymaking."

## DOUBLE-SHIFT POWER-PRESS CREWS.

In some parts of the prairie hay section, where it is very hot and crews work long hours, it is customary to use two shifts of feeders and pitchers. This arrangement is used only when a large amount of hay is baled. One crew in Oklahoma, which is handled in this way, is composed of 17 men, 10 of whom work at the press. They start working at 5.30 in the morning and work until 7.30 in the evening, with an hour out for dinner between 12 and 1 o'clock. There are four pitchers, two feeders, two wirers, one off-bearer, and one foreman. Only two pitchers and one feeder work at a time, and then in half-hour shifts. The foreman tends the engine and supervises the work of mowing, sulky raking, push raking to the press, and baling. By allowing the pitchers and feeders time to rest and "cool off" half of the time, the press is kept running steadily all day long, day after day, during the entire haying season. This crew bales on an average 35 tons per day and a total of over 2,000 tons during the season. A canvas "fly" placed over the press adds greatly to the comfort of the workmen, as it protects them from the direct rays of the sun.

## COST OF BALING HAY.

The up-to-date hay grower should have a fairly accurate knowledge of the cost of baling hay, especially if he uses baled hay for feeding or sells baled hay or loose hay that is to be baled afterwards. Those who sell loose hay to be fed locally are the only market hay growers not interested in the cost of baling. Hay buyers often make two prices for hay, one for loose and another for baled hay. If the average cost of baling were known, the hay grower would be able to determine with a fair degree of accuracy which practice would pay him best, to do his own baling, hire it done, or sell it unbaled.

The labor requirements and cost per ton for baling from the windrow in the prairie hay section of northeastern Oklahoma and for baling from the cock in the alfalfa and Johnson grass belt of Central Georgia, Alabama, and Mississippi are given in Table 1<sup>1</sup>. In Okla-

<sup>1</sup> *Prairie hay data.*—Twenty-eight records of crews were taken in the survey. In 16 instances power presses were used and in 12 the hay was baled with 2-horse presses. The 28 records represent many more crews than the number used in tabulating the results. The reason for this is that many shippers had several crews at work. One firm runs two outfits, each composed of three press crews, working as separate units. The amount of hay baled by all of the crews amounts to over 20,000 tons per year, more than half of the hay in Craig County, Okla., where the survey was made, or as many acres of hay as are grown on 950 average-sized farms in New York State. The number of records, under the circumstances, is ample to give accurate results.

*Alfalfa hay data.*—The figures on cost of baling alfalfa hay in the "black belt" of the South were taken from 105 farms where hay was grown for the market. Two-horse presses were used on 21 farms and a total of 8,859 tons are baled yearly. Power presses were used on 84 farms and a total of about 50,000 tons are baled yearly. In each instance the information is ample to give accurate cost.

homa skilled white labor is used; in the South rather inexperienced colored labor.

TABLE 1.—Labor requirements and cost per ton of baling hay.

Item.	Baling with power presses.		Baling with horse presses.	
	Prairie hay belt.	Alfalfa belt.	Prairie hay belt.	Alfalfa belt.
Average number of men in crew.....	5	6	4	4
Hours worked per day.....	9.30	10.50	9.30	10.50
Tons baled per day.....	21.00	14.50	10.00	7.20
Man hours, per ton.....	2.21	4.33	3.72	5.80
Cost of man labor <sup>a</sup> .....	\$0.773	\$0.43	\$1.30	\$0.58
Horse hours per ton.....	.....	.....	1.86	2.91
Cost of horse labor <sup>b</sup> .....	.....	.....	\$0.279	\$0.387
Cost of gasoline and oil <sup>c</sup> .....	\$0.14	\$0.21	.....	.....
Repairs, etc., on press.....	\$0.07	\$0.15	\$0.09	\$0.08
Total cost per ton, except wire....	\$0.98	\$0.79	\$1.67	\$1.04

<sup>a</sup> Rate for white labor in prairie hay belt, 35 cents per hour; rate for colored labor in alfalfa belt, 10 cent per hour.

<sup>b</sup> Rate for horse labor in prairie hay belt, 15 cents per hour; rate in alfalfa hay belt, 13 cents per hour.

<sup>c</sup> Based on a charge of \$3 per day for gasoline and oil.

The cost of baling prairie hay from the windrow, with the power press, amounted to 98 cents per ton, while the cost of baling with a 2-horse press was \$1.67. In the alfalfa and Johnson grass belt of the South the cost was 79 cents for baling with the power press from the cock and \$1.04 for baling with the horse press.

The prewar price charged by custom balers was from \$1.50 to \$2 per ton. When the minimum rate was charged the hay grower was sometimes required to furnish enough pitchers to deliver the hay to the feeder. In some instances, the hay grower also boarded the crew. Within the last year or two the rate for baling hay has been considerably increased. A charge of from \$2.50 to \$3.50 per ton is not uncommon in many sections at present. This price may or may not include the cost of the wire and of getting hay to the press.

From the cost figures shown in Table 1, it will be seen that in both sections there is quite a difference between horse and power presses in cost of baling.

No figures are available on the cost of baling hay from the stack or barn. This may be easily estimated, however, since the crews specified in Table 1 are large enough to be used for baling from the ordinary-sized barn or stack. In some instances it may be neces-

sary to add to the crew one or two more men, such as another pitcher and an off-bearer. The same crew should be able to bale more hay per day from a barn or stack than from the windrow, since well-settled barn and stack hay is much more dense than windrow hay and more of it can be fed into the press in the same length of time, provided it has been stacked or put into the barn properly; that is, spread out evenly and not left in bunches as dropped by the horse fork or stacker.

### HIRING A PRESS.

The hiring or loaning of hay presses does not seem to be a general practice. In the Northeastern timothy hay section presses are not hired, because most of the baling is done by custom balers, most of whom use their presses a large part of the time. In the South, hay grown for the market is often baled from the cock or windrow, or as soon as it has gone through the sweat; and the press is needed by the grower much of the time throughout the summer (alfalfa and Johnson grass hay is cut from three to five times), and there would be little opportunity for hiring out or loaning a press to bale an entire cutting, even though the owner were inclined to do so. It is customary, however, in the South, where nearly every large hay grower owns a press and is familiar with its operation, to loan the press for a day or a few days whenever possible to a neighbor whose press is out of commission, until it can be put into running condition.

It is generally much easier to hire a horse press than a power press, since the horse press is less complicated than the power press and less liable to damage through carelessness or inexperience.

### ADVISABILITY OF OWNING A HAY PRESS.

The advisability of buying a hay press depends upon the amount of hay to be baled yearly, the likelihood of being able to obtain a crew when needed, and the rate charged by those making a business of doing custom baling.

Whether it will pay the grower to own a press depends upon whether the total cost of baling per ton, including labor, repairs, interest, and depreciation, is less than the rate charged by the custom baler.

The machinery charges shown in Tables 2 and 3 may assist the hay grower in determining the advisability of owning a press.<sup>1</sup> Twenty years is taken as the extreme limit of service for a press that bales 500 tons or under per year.

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<sup>1</sup> See footnote regarding source of data, p. 26.

**TABLE 2.—Interest and depreciation charges on power presses, according to tons baled per year.**

**[Cost of press and engine, \$700; extreme limit of service 20 years, or 15,000 tons with skilled labor and 8,000 tons with unskilled labor.]**

Tons baled per year.	Life of press (years).	Total tons baled during life.	Total interest during life of press.	Interest per ton baled.	Repairs, interest, and depreciation per ton baled.
<b>Press operated by either skilled or unskilled labor.</b>					
50	20.0	1,000	\$367.50	\$0.367	\$1.067
75	20.0	1,500	367.50	.245	.711
100	20.0	2,000	367.50	.183	.533
150	20.0	3,000	367.50	.123	.355
200	20.0	4,000	367.50	.081	.266
250	20.0	5,000	367.50	.073	.213
300	20.0	6,000	367.50	.061	.177
350	20.0	7,000	367.50	.052	.152
400	20.0	8,000	367.50	.041	.133
<b>Press operated by unskilled labor.</b>					
500	16.0	8,000	\$297.50	\$0.037	\$0.124
600	13.3	7,980	250.25	.031	.119
700	11.4	7,980	217.50	.027	.114
800	10.0	8,000	192.50	.024	.111
900	8.8	7,920	171.50	.021	.110
1,000	8.0	8,000	157.50	.019	.107
1,500	5.3	7,950	110.25	.013	.101
2,000	4.0	8,000	87.50	.011	.098
<b>Press operated by skilled labor.</b>					
500	20.0	10,000	\$367.50	\$0.036	\$0.106
600	20.0	12,000	367.50	.030	.088
700	20.0	14,000	367.50	.026	.076
800	18.7	14,960	345.60	.023	.067
900	16.6	14,940	309.00	.021	.066
1,000	15.0	15,000	280.00	.018	.065
1,500	10.0	15,000	192.50	.012	.059
2,000	7.5	15,000	148.75	.009	.056

Interest and depreciation charges are rather high when small amounts of hay are baled yearly with a power press (see Table 2). If only 50 tons are baled per year these charges amount to about

\$1.06 per ton, which will in many instances make the total cost of baling higher than the rate charged by those who make a business of doing custom baling. The charges decrease rapidly as the amount baled per year increases. There is little variation in the interest and depreciation charges per ton of hay baled after the amount baled per year rises above 400 tons. In other words, interest and depreciation charges on power presses are important factors in the cost of baling hay only when less than about 400 tons per year are baled.

A power press can be used economically for a smaller acreage baled from the field than when the hay must be baled from the barn or stack, as it costs considerably more to produce hay that is put into the stack or barn and afterwards baled than it does to bale it directly from the windrow or swath.

Horse presses cost from one-half to one-third as much as power presses, and consequently they can be recommended for much smaller acreages or tonnages than power presses. The interest and depreciation charges on a horse press amount to comparatively little when the amount baled yearly is above 250 tons. These charges, for amounts baled per year varying from 25 to 1,000 tons, are given in Table 3.

TABLE 3.—Interest and depreciation charges on 2-horse presses according to amount baled per year.

[Cost of press, \$250; extreme limit of service, 20 years or 5,000 tons.]

Tons baled per year.	Life of press (years).	Total tons baled during life of press.	Total interest during life of press.	Interest per ton of hay baled.	Repairs, interest, and depreciation per ton of hay baled.
25	20.00	500	\$262.50	\$0.525	\$1.025
50	20.00	1,000	262.50	.262	.512
75	20.00	1,500	262.50	.175	.341
100	20.00	2,000	262.50	.131	.256
150	20.00	3,000	262.50	.087	.170
200	20.00	4,000	262.50	.060	.128
250	20.00	5,000	262.50	.052	.102
300	16.66	5,000	110.00	.022	.072
350	14.28	5,000	96.25	.019	.069
400	12.50	5,000	84.38	.017	.067
500	10.00	5,000	68.75	.013	.063
600	8.33	5,000	58.12	.011	.061
700	7.14	5,000	50.62	.010	.060
800	6.25	5,000	45.00	.009	.059
900	5.55	5,000	40.60	.008	.058
1,000	5.00	5,000	37.50	.007	.057

In most sections where hay is grown for the market, the owner of a press who has a small acreage can often greatly reduce the machinery charges for baling his own hay by doing custom work for others.

It is sometimes feasible for the small hay grower to join with several others in buying a press. A press owned cooperatively can not be used to any great extent for baling hay from the windrow or cock, but mostly for baling from the stack or barn. If a power press is purchased, especially if of the motor type—that is, with engine mounted on hay press frame—it may be to the advantage of all for one man who is handy with gas engines to take charge of the press at all times when in use; otherwise a costly breakdown may cause trouble over the question of sharing the expense for repairs. Where tractors are used it may prove most advantageous to purchase a belt-driven press. For cooperative ownership, however, a 2-horse press is to be recommended to those whose acreage is small and who have the time and help to bale their hay during the fall and winter. The 2-horse press is simply made and easy to operate, and the cost of repairs should be a very small item if ordinary care is exercised when it is used.

More skill is required to operate a power press than to operate a horse press. Most of the delay in baling hay is caused by a stoppage of the power. The starting of a gasoline engine on a power press is very often a hard matter, since engine troubles are sometimes hard to locate and remedy, even with the best makes of engines. Usually it would be better to buy a good horse press than a power press, except in cases in which some member of the crew can run an engine.

#### ADVANTAGES OF BALING FROM THE FIELD.

The practice of baling hay directly from the windrow or cock originated in the semiarid West, where the weather does not often interfere with haymaking. Strange to say, this practice has spread southward to the alfalfa and Johnson grass hay areas, where the weather is often unfavorable for haymaking, rather than to the timothy and clover area of the East, as might naturally be expected, since there the weather is more favorable for baling from the field than farther south.

This method offers a considerable saving in labor compared with stacking or putting hay into the barn. In the alfalfa sections of Kansas and Nebraska, for example, it requires about 1½ man hours and 1 horse hour to put a ton of hay into the stack with a stacker after it has been brought to the stack with the push rake. The cost of labor for stacking alone is at present (1918) about 60 cents per ton. This work is entirely eliminated when hay is baled from the



field. The saving of labor in baling from the field is much greater in sections where it is the custom to handle hay by hand.

The amount of hay that the farmer can safely undertake to bale from the field depends on the kind of hay, length of haymaking season, type of press to be used, and availability of labor. The season for making prairie hay extends over a rather long period, which allows plenty of time for baling from the windrow on the average-sized farm. The season for tame hay, on the other hand, is rather short, and in many instances it is not safe to count on more than two weeks, under average conditions, for making hay. The haymaking season can be lengthened somewhat if the hay is cured in the cock, as cocked hay can often stand several days after it is cured out. This makes it possible to bale a larger acreage of good hay than when the hay is baled from the windrow, where it can not remain very long without deteriorating in color.

If a horse press is used it is safe to assume that at least 10 tons can be baled per day, making it possible to cure and bale from 100 to 150 tons during the haying season. A power press will handle considerably more hay, depending upon the size and ability of the crew; perhaps from 200 to 375 or more tons in two weeks during favorable weather.

Some growers who own presses do not plan to use the press continuously during the tame haymaking season, but bale from the field only when there are indications of good weather for a few days. Some prefer to make as much hay as possible during the first part of the season, putting the hay into the barn or stack, and to bale toward the end of the season when hay cures out rather rapidly and the risk of injury due to unfavorable weather is less.

### **MARKING THE WEIGHT OF BALES AND ITS EFFECT ON PRICES.**

It is a common practice in many sections of the country to weigh each bale and tag it with its weight as it is taken from the press, in order that the baler may know the quantity pressed, and to avoid the necessity of weighing when the hay is sold where wagon scales are not easily accessible.

Tag weights in general, no matter how accurate, are not reliable except when the hay is immediately shipped to market. They have caused much trouble in city markets, and at present are very little used. New hay if stored for some time will lose weight by shrinkage. A 200-pound bale may lose 10 to 12 pounds in the course of several months. On the other hand, hay baled dry may gain in weight during a continued period of wet weather. Grain or alfalfa

hay often weighs less than the tag weight on account of the loss resulting from handling the bales.

Then again, the weight is often marked up so as to make totaling easier for the weigher. For example, if a bale weighs 83 pounds it may be marked 85. This increases the profit of the baler in case the baling is done by the ton. In some localities it is customary to weigh 10 or 15 bales when a new stack or mow is opened, and use the average for all bales that apparently run even, thus saving time and labor for the weigher. It sometimes becomes necessary, however, to tighten or loosen the tension after such an average weight has been determined, and if the off-bearer or weigher then forgets to take a new average the weights will be incorrect.

When a producer insists on selling his hay by tag weights the price offered is likely to be considerably lower than would be offered if the hay were to be weighed on wagon scales at time of delivery.

## CARE OF BALED HAY.

### AT THE PRESS.

If baled hay must be left in piles near the press until the baling is finished it should be protected from rain. This is done most commonly by covering the bales with spoiled hay from the stack or with newly made hay from the windrow or cock. This method will protect the bales if enough loose hay is used, but it requires considerable time, and even then a long, hard rain is very likely to penetrate the covering and damage the bales on top of the pile.

A better way is to have always at hand a large canvas or tarpaulin that can be thrown over the hay in a very few minutes. If well tied to the bales this will not be blown off and if of heavy canvas will keep the bales perfectly dry. After being used it should be dried out thoroughly and folded up. The tarpaulin should always be taken to the stack or field with the press, ready for immediate use, otherwise the hay may be badly damaged by sudden rain.

### PROTECT THE PARTLY-BALED STACK.

A partly-baled stack will often be wet by rain to a depth of several inches, making it necessary to throw off the wet hay or else wait until it is dried out, entailing considerable delay to the baling crew. It is a good practice to have a second large canvas to throw over the top of the stack in such emergencies. As soon as the rain ceases the canvas may be removed and the press started, and thus no unnecessary time will be lost.

## STORING BALED HAY.

Baled hay that has been thoroughly cured in the barn or stack before baling can be stored indefinitely without danger of heating. It may be piled so that the bales fit very closely together. Hay baled from the windrow and cock, however, unless very well cured, is likely to heat more or less in storage. Sometimes the heating becomes so intense that the hay becomes severely damaged or even unmarketable.

Damage from heating may be greatly lessened and sometimes entirely obviated by storing the bales on edge, allowing an inch or two of air space between them. When bales are piled flatwise the air is excluded and heating is likely to occur, whereas leaving an air space tends to prevent heating by inducing circulation, which cools the hay. The first layer of bales placed in a barn should be placed on edge, and the second and every alternate layer should be placed on edge and crosswise. This crosswise method or "cording" prevents any of the air spaces in the tier from being entirely covered and insures ventilation through the entire pile. The heated air works up around the edges of the bales and the cooler air enters from the sides and bottom.

When bales that have been laid flat on their sides begin to heat it becomes necessary to move the bales and pile them in the manner just described. If there are any indications of heating when the hay is put into the barn, or if the hay grower has any doubt about the hay keeping, it is best to pile the bales crosswise on edge, rather than take any risk, even though this method of storing wastes more or less storage space. Cases are on record in which hay growers, usually beginners, have baled hay from the windrow and cock, and because it spoiled in the mow, owing to improper storing, have become convinced that baling from the field was not a success, not realizing that the fault lay in the manner in which the hay was stored.

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